R J Vargo 5/18/2004

DRF1 Driver amplifier tune-up procedure:

Tuning may be required when a tube is replaced or other failure that necessitates any moving of critical components.

Description:
The driver amplifier (Fermilab built, 8000-ED-119523) consists of two stages. A pre-driver using an EIMAC 8877 grounded grid triode and a 180-degree power split output to drive two more grounded grid 8877's in push-pull. Each stage has adjustable input and output circuits to match for 50 Ohms. It is these adjustments that this note is about.

Goal:
To provide a maximum output signal into 50-Ohm loads. (Use the Bird model 8327-300 power attenuators, see picture on back, located under bench at AP50). Maintain a 180-degree phase difference between the two outputs as observed on an oscilloscope.

Actions and tips:
To do this, all the equipment used in its working environment may be used (HV, bias, filament, control and interlocks, etc). Note: this requires a working PA connected, as the interlock chassis needs signaling to operate. I recommend using a short duration drive pulse (200uS @ 2Hz) from a signal and pulse generator with a balanced mixer driving an ENI 3100LA. Also a home built test generator (800-EC-288292) may be used for this purpose (located in the Debuncher racks). See drawing.

Tools required:
An insulated $3/16^{th}$ in. flat blade non-conducting tool. Used for adjusting variable capacitors with slotted shafts. Please note that non-conducting tool is <u>essential</u> due to high voltage in the circuit. AND matched electrical delay cabling for accurate phase adjustment (important).
System and specific drawings are also useful. These are located in a binder at AP50 as well as archived in EE support:
8000-EE-119538 …… High Level RF System Block Diagram.
8000-EC-119523 …… Debuncher Driver Pre-Driver Schematic (this subject).
8000-EC-119522 …… Debuncher Cavity Power Amplifier Schematic.

Procedure:
Please see the block drawing and pictures below for reference. Adjust according the schedule below. Note: Adjacent equipment may impede easy access. You may pull the amplifier forward using the sliding rails that it is mounted on (undo those wire ties!).

(1) Pre-driver input. Max amplitude at both outputs
(2) Pre-driver output. Max amplitude at both outputs

(3&4) Final input. Max amplitude at corresponding output
(5&6) Final output. Max amplitude at corresponding output

Gradually increase the drive input to below the approximate saturation point and repeat the above. (Never over saturate during tuning, as amplitude changes will not be seen)

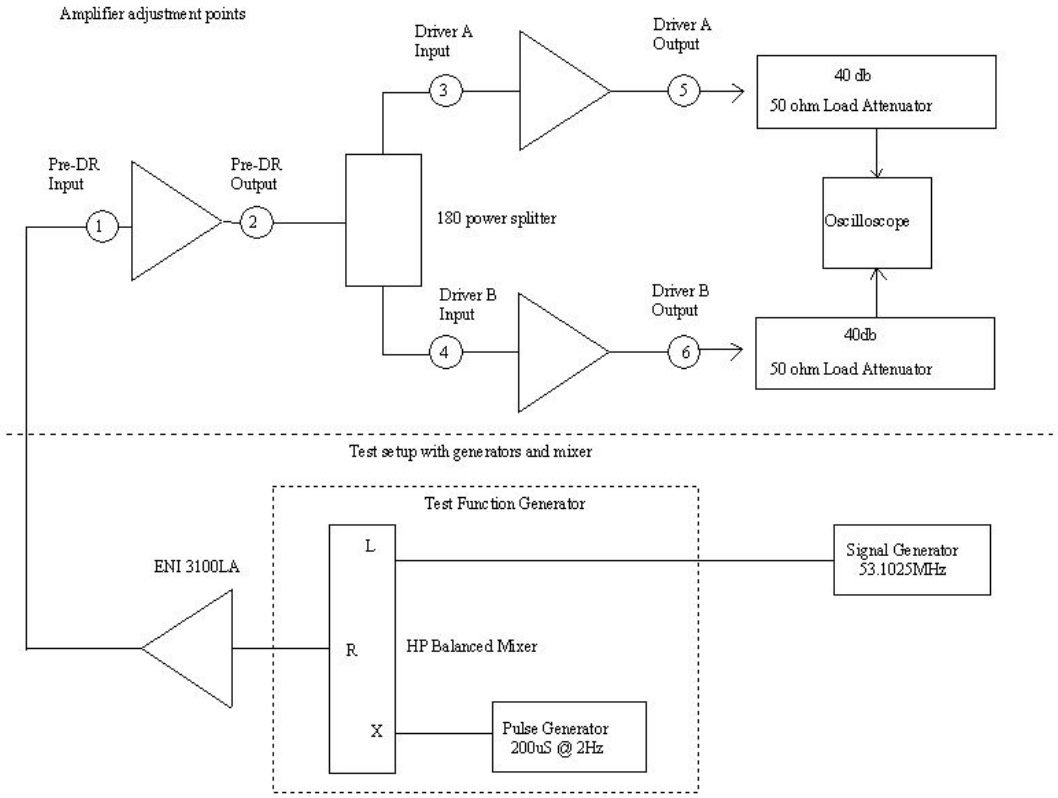
Please note that one output is larger than the other (normal), it is this side that efforts are made to correct for the 180-degree phasing. Adjust 3&4 or 5&6 (appropriate side) for the 180-degree phase relationship. You will find that the amplitudes are close and the phase is correct for the push-pull drive required at the PA on the cavity. Also note that the output tuning has the largest affect of phase and amplitude adjustment.

At saturation, the typical expected amplitudes are ~ 850Vpk at the output (8.5Vpk on scope). The amplifiers' gain can vary (typical 30dB gain).

The tuning components are typically stable and require only little "tweaking" over time.

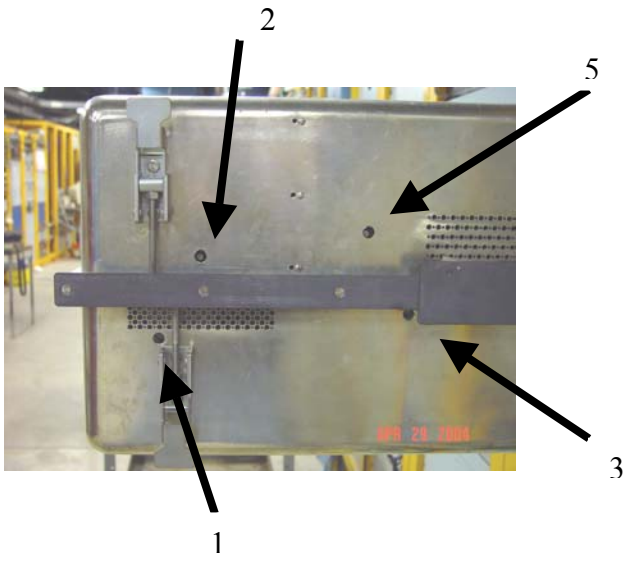
The amplifier is ready for connection to the cavity PA. Any adjustments for system improvements should be done at the cavity PA input circuits, as the driver is optimized for a 50-Ohm load (which the cavity PA should present to this amplifier). No further driver adjustments should be done.

Simplified block drawing showing adjustment points

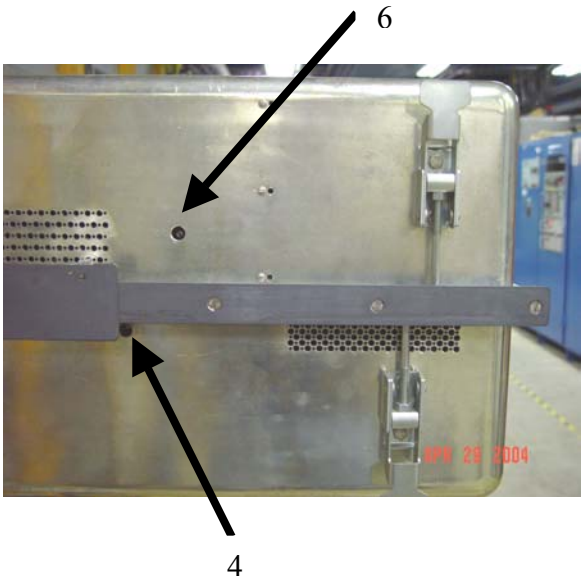


Amplifier in its natural surroundings

Recommended Load
Attenuators

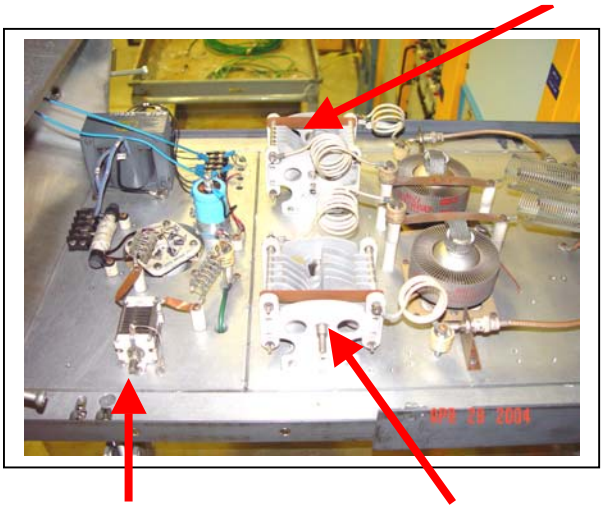


Adjustment access point (right side view)



Adjustment access points (left side view)

Top view showing adjustable components



Bottom view showing adjustable components